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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/698,865      | 10/30/2003  | Lynn Forester        | 30-4899 DIV -4780   | 2624             |

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10/03/2005

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| EXAMINER |
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ARENA, ANDREW OWENS

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| ART UNIT | PAPER NUMBER |
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2811

DATE MAILED: 10/03/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

|                              |                                      |                                       |  |
|------------------------------|--------------------------------------|---------------------------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b><br>10/698,865 | <b>Applicant(s)</b><br>FORESTER, LYNN |  |
|                              | <b>Examiner</b><br>Andrew O. Arena   | <b>Art Unit</b><br>2811               |  |

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 9/20/2004.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 21-35 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 21-35 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 October 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)               | Paper No(s)/Mail Date. _____  |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>01/26/2004</u> .  | 6) <input type="checkbox"/> Other: _____                                    |

## **DETAILED ACTION**

### ***Claim Objections***

1. Claim 27 is objected to because it recites "the layered material of clam 27". A claim cannot depend from itself. It seems claim 27 is meant to depend from claim 26. Appropriate correction is required.

### ***Claim Rejections - 35 USC § 112***

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 22 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

4. Claim 22 recites "wherein the hard mask layer further comprises and an etch resistivity of a via dielectric layer." This statement is unclear because a hard mask cannot comprise "and" or "an etch resistivity", also, there is no antecedent basis for the "via dielectric layer". It seems applicant seeks to claim "wherein the layered material further comprises a via dielectric layer below the line dielectric layer, wherein said hard mask layer has an etch resistivity that further is greater than an etch resistivity of the via dielectric layer." Appropriate correction is required.

### ***Claim Rejections - 35 USC § 102***

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

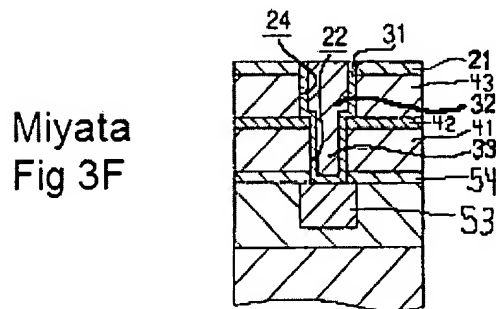
A person shall be entitled to a patent unless –

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(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 21-24, 28, and 34-35 are rejected under 35 U.S.C. 102(e) as being anticipated by Miyata et al. (US 6,333,258), hereinafter Miyata.

7. Examiner has attached a copy of Miyata Fig 3F including reference labels for the layers which were labeled in Miyata Fig 3E, but whose labels were left out Fig 3F.



8. Regarding claim 21, Miyata discloses (Fig 3F) a layered material, comprising:  
a hard mask layer (21; col 11 ln 4-5), and  
a line dielectric layer (43; col 9 ln 31-32), wherein the hard mask layer is applied to the line dielectric layer (col 11 ln 4-6), wherein the hard mask layer comprises a Si-N bond (col 9 ln 59), and

wherein the hard mask layer has an etch resistivity (for example, to etchant used in col 11 ln 54-67) that is greater than an etch resistivity of the line dielectric layer (such resistivity is inherent in the process of col 11 ln 54-61).

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9. Further regarding claim 21, the product-by-process limitations "is applied in a liquid phase" and "is densified" have not been given patentable weight. The case law establishing this precedent follows:

"Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

10. Regarding claim 22, examiner has interpreted this claim as "wherein the layered material further comprises a via dielectric layer below the line dielectric layer, wherein said hard mask layer has an etch resistivity that further is greater than an etch resistivity of the via dielectric layer." Miyata discloses a via dielectric layer (41; col 8 ln 58-59) wherein the hard mask layer has an etch resistivity (for example, to etchant used in col 11 ln 54-67) that is greater than an etch resistivity of the via dielectric layer (such resistivity is inherent in the process of col 11 ln 54-61).

11. Regarding claim 23, Miyata discloses the line dielectric layer comprises an organic low dielectric constant material (col 9 ln 31-33).

12. Regarding claim 24, Miyata discloses wherein the organic low dielectric constant material is a polyimide (col 9 ln 40-41).

13. Regarding claim 28, Miyata discloses the layered material of claim 21, the limitation "is densified using a process selected from the group consisting of a furnace cure process, a rapid thermal anneal process, a hot plate anneal process, and an electron beam process" is a product-by-process limitation, and has not been given patentable weight.

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14. Regarding claim 34, Miyata discloses a dual damascene structure (inherent in structure of Fig 3F, implied in col 1 ln 35) comprising the layered material of claim 22 and a metal element (32; col 12 ln 39-40).

15. Regarding claim 35, Miyata discloses wherein the metal element comprises copper (32; col 12 ln 39-40).

***Claim Rejections - 35 USC § 103***

16. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

17. Claims 25-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Miyata in view of Morisawa et al. (Ref U on PTO-892), hereinafter Morisawa.

18. Examiner has added lettered reference labels to the enclosed copy of Morisawa, for ease of reference in this rejection.

19. Regarding claim 26, Miyata discloses the hard mask layer is a silane-based material (silicon nitride; col 9 ln 59), but does not disclose the hard mask layer is formed from a polyperhydrosilazane. Morisawa calls this material perhydrosilazane (PHSN; B), but it is understood that the subscript n on the monomer shown in Fig 1 symbolizes a polymer, and that this PHSN could equivalently be called polyperhydrosilazane. Morisawa teaches that this material is preferable to the silane-based material (A) of Miyata. The field of endeavor is protective layers in microelectronic structures for both

Miyata and Morisawa. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to make the hard mask using the polyperhydrosilazane material PHSN taught by Morisawa in place of the silane-based material of Miyata; at least for the purpose of spin-on processing compatibility (A).

20. Regarding claim 27, Morisawa discloses the polyperhydrosilazane has a structure represented by  $(\text{SiH}_2\text{-NH})_n$  (Fig 1), but does not expressly disclose wherein  $n$  is an integer between 2 and 2000. However, it would have been obvious to a person of ordinary skill in the art at the time the invention was made that  $n$  be an integer between 2 and 2000, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

21. Regarding claim 25, even though “application of the hard mask in liquid phase comprises a spin-on process” is a product-by-process limitation, Morisawa still anticipates that application of the hard mask in liquid phase comprises a spin-on process (A, C).

22. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Miyata in view of Powell et al. (US 6,410,968), hereinafter Powell.

23. Regarding claim 29, Miyata discloses the layered material of claim 21, but does not disclose a diffusion barrier layer. Powell discloses (Fig 1A) a diffusion barrier layer (102; col 2 ln 26) formed on an electrode (108; col 2 ln 21). The field of endeavor is dielectric layers in microelectronic structures for both Miyata and Powell. Therefore, it

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would have been obvious to a person of ordinary skill in the art at the time the invention was made to form a diffusion barrier as taught by Powell over the layered structure of Miyata; for at least the purpose of preventing oxidation of the copper wiring (col 2 ln 37).

24. Claims 30-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Miyata in view of Powell as applied to claim 29 above, and further in view of Morisawa.

25. Regarding claim 31, Powell discloses the barrier layer is formed from a silazane source (col 2 ln 29), but does not expressly disclose the material. Morisawa teaches PHSN as a preferred silazane (A, B), and discloses this material comprises a Si-N bond (Fig 1). The field of endeavor is protection layers in microelectronic structures for both Powell and Morisawa. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to make the silazane layer of Powell of PHSN as taught by Morisawa; for at least the purpose of spin-on processing compatibility (A).

26. Regarding claim 32, Morisawa discloses the silazane is polyperhydrosilazane (PHSN; B). Morisawa calls this material perhydrosilazane, but it is understood that the subscript n on the monomer shown in Fig 1 symbolizes a polymer, and that this PHSN could equivalently be called polyperhydrosilazane.

27. Regarding claim 33, Morisawa discloses the polyperhydrosilazane has a structure represented by  $(\text{SiH}_2\text{-NH})_n$  (Fig 1), but does not expressly disclose wherein n is an integer between 2 and 2000. However, it would have been obvious to a person of ordinary skill in the art at the time the invention was made that n be an integer between



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2 and 2000, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

28. Regarding claim 30, even though "applied in a liquid phase" is a product-by-process limitation, Morisawa still anticipates application in liquid phase (spin-on process: A, C).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Andrew O. Arena whose telephone number is (571) 272-5976. The examiner can normally be reached on M-F 8:30-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven Loke can be reached on (571) 272-1657. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Steven Loke  
Primary Examiner  
